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N735 N75X N771
U1S S1714 S2287 S2296 S3069 S3072**

(56) Documents cited
**GB 2057355 A GB 1108284 A EP 0396349 A2
EP 0389208 A1 EP 0227470 A2**

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(54) **Laminated glazing material**

(57) A glazing material comprising a laminate of first and second layers of glass, sandwiching a layer of polymeric material, in which the layer of polymeric material attenuates ultraviolet radiation and the laminate is colourless.

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

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FIG.1.

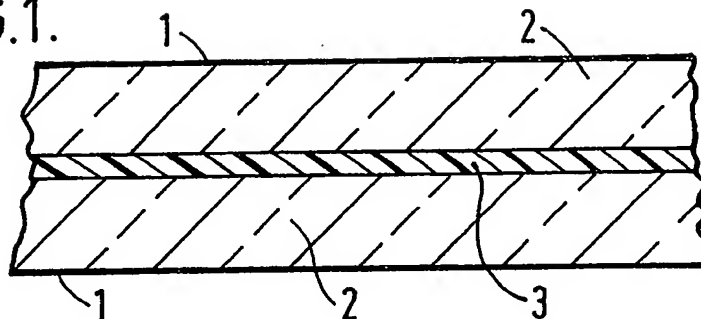
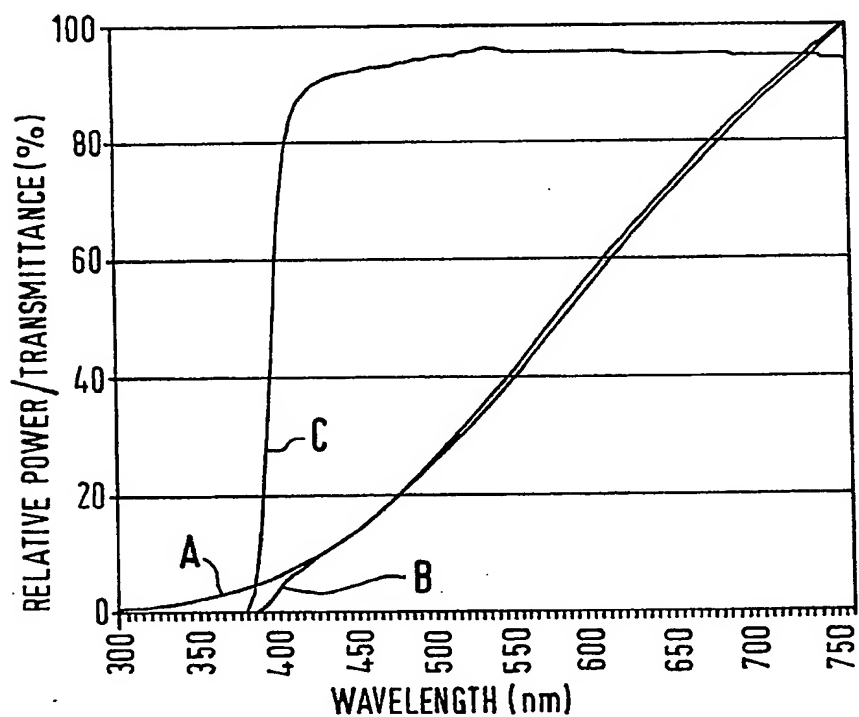


FIG.2.



SOURCE: CIE SOURCE A (TUNGSTEN)

FILTER: RANKIN LOW-REFLECTING CLEAR LAMINATED GLASS

UV CONTENT = 5 MICROWATTS PER LUMEN

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LAMINATED GLAZING MATERIALDESCRIPTION

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The present invention relates to a laminated glazing material. In particular, the present invention relates to a laminated glazing material, which is virtually colourless.

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When a valuable oil painting or drawing is exhibited, there are certain circumstances which make it desirable for the work of art to be covered by a transparent screen. Some paintings are particularly susceptible to the effects of ambient ultraviolet radiation, which can cause physical deterioration or colour changes in the pigment, making it desirable to shield the painting from such radiation. Old sketches or drawings are susceptible to atmospheric moisture, making it desirable to exhibit them in substantially sealed display cabinets. In the case of a particularly valuable painting, it may prove desirable to afford

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protection against acts of malicious vandalism, by inserting a transparent screen between the painting and members of the general public.

5 Suitable screens and cabinet materials include float and toughened glass or, more preferably, laminated glass; the latter comprising two layers of glass sandwiching a layer of transparent polymeric material. A single sheet of glass may not be sufficiently
10 resilient to prevent it from shattering upon impact, thus presenting a potential hazard to painting and public alike from shards of broken glass. Laminated glazing materials possess enhanced resilience and have the added advantage that, even after shattering, the
15 shards tend to be cohesive.

It is possible to modify glass, by the addition of substances that absorb ultraviolet radiation, so that the resultant glass filters out the ultraviolet
20 component of incident light, but transmits the visible component. However, all commercially suitable glasses which provide the required degree of protection from ultraviolet radiation, have a residual colouring

sufficient to distort the natural hue of objects viewed through them. Thus, such glasses are unsuitable as protective screens for works of art.

- 5 Colourless float glass is known and, for example, may be obtained from AFG Industries Incorporated of Kingsport, Tennessee, U.S.A. under the Trademark KRYSTAL KLEAR. The term "colourless" as applied to a glazing material, is understood to mean that, when used in an
10 appropriate thickness, the material is transparent and absorbs little or no radiation within the visible region of the electromagnetic spectrum, such that the hue or colour of objects, viewed through the material, remains substantially unchanged to the human eye.
- 15 However, this known material is neither toughened, nor does it absorb sufficient ultraviolet light to protect a vulnerable work of art.

- 20 According to a first aspect of the present invention, there is provided a glazing material comprising a laminate of a first and second layer of glass, sandwiching a layer of polymeric material, wherein the

layer of polymeric material attenuates ultraviolet radiation and the laminate is colourless.

5 Preferably, the layer of polymeric material attenuates ultraviolet radiation sufficiently for the laminate to filter enough of the ultraviolet, present in ambient light (either natural or artificial), for it to provide useful protection for a vulnerable work of art. Thus the laminate, preferably, filters out at least 90%
10 and more preferably, at least 98% of the ultraviolet radiation from incident ambient light. In this latter respect ultraviolet radiation is defined as that portion of the electromagnetic spectrum having a wavelength of between 297 and 377 nm, although the
15 laminate can be effective between 190 nm and 400 nm.

Thus, advantageously, if a coloured object is viewed through the inventive laminate, the colour observed by the viewer would be of the same hue as the object,
20 within the limits of sensitivity of the viewer's eye; the laminate also serving to filter out potentially harmful ultraviolet radiation from ambient light falling upon an object viewed through the material.

In an embodiment, the polymeric material is selected such that the layer thereof in the laminate provides a majority and, preferably, over 90% of the ultraviolet attenuation, is sufficiently thin to remain colourless (in a transverse direction) and is sufficiently tough and resilient to provide enhanced strength and impact resistance to the laminate. Thus, advantageously, a glazing material in accordance with the invention can be used to cover a work of art and provide it with the protection against acts of vandalism normally associated with conventional laminated glass, while also being colourless and blocking out ultraviolet radiation.

In an embodiment, the layer of polymeric material is between 0.2 mm and 1.4 mm in thickness. Preferably, the layer of polymeric material is between 0.4 mm and 1.2 mm in thickness and, more preferably, is between 0.6 mm and 1.0 mm in thickness. In a further embodiment, the layer of polymeric material comprises a cured polyester resin, such as that available from British Industrial Products Limited under the Trademark UNILAM.

Preferably, the first and second layers of glass are formed from a colourless glass which, preferably, has an iron content of less than 0.03%. The most preferred glass is that available from AFG Industries under the
5 Trademark KRYSTAL KLEAR.

In an especially preferred embodiment, at least one surface of the laminated glazing material according to the invention is non-reflective.

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In this context, the term "non-reflective" is used to describe a glazing material having a surface which causes less incident visible light to be reflected than would be reflected at the surface of a conventional
15 glazing material. Non-reflective glazing materials may be prepared by applying a thin coating of a substance which absorbs incident light, typically a metal oxide, to the surface of the glass. Such coatings and the methods by which they may be applied are well known in
20 the art.

Preferably the laminated glazing material is rendered non-reflective by coating one surface of the glass with a sputtered metal oxide, preferably iron oxide, prior to laminating. Thus, the glazing material can be
5 formed from glass coated on one surface with a sputtered metal oxide, which is preferably is iron oxide. In an embodiment, the non-reflective coating reduces the residual reflection of the glass from about 8% to about 1%, at 90° to the glass surface.
10 Preferably a photopic reflectance of 0.25% or less is achieved per coated side. The index range is, preferably, 1.46-1.56.

According to a second aspect of the invention, there is
15 provided a picture frame comprising a laminated glazing material in accordance with the first aspect of the invention.

According to a third aspect of the invention, there is
20 provided a display cabinet for viewing an object contained therein comprising at least one pane of laminated glazing material according to the first aspect of the invention.

In a fourth aspect, the invention provides the use of a laminating material for providing a colourless laminate which attenuates ultraviolet radiation, wherein the laminating material forms a polymeric layer in the
5 laminate. Preferably, the resulting polymeric layer is a cured polyester.

A specific embodiment of the present invention will now be described by way of example only and with reference
10 to the accompanying drawings:-

Figure 1 is a scrap cross section through a sheet of laminated glazing material in accordance with the present invention and;

15 Figure 2 shows, graphically, the transmittance of a sample of laminated glazing material in accordance with the invention.

The glazing material shown in Figure 1 comprises two
20 outer layers of colourless float glass 2 (available from AFG Industries Incorporated, Kingport, Tennessee, U.S.A., under the Trademark KRYSTAL KLEAR), sandwiching a cured polyester resin 3 (available from British

Industrial Products Limited, under the Trademark UNILAM). Each of the layers of float glass 2 have outwardly facing non-reflective surfaces 1.

- 5 The sheet of material illustrated in Figure 1 is manufactured by first coating two sheets of colourless float glass, on one side only, with a layer of sputtered metal oxide to render it substantially non-reflective. The metal oxide is preferably an iron
10 oxide, or a mixture of oxides including an iron oxide. The sheets of non-reflective glass are then held apart, with their coated surfaces outermost, and uncured resin is poured into the resulting gap and, thereafter, allowed to cure under the influence of a conventional
15 catalyst and accelerator mix. In a typical finished product, the layers of glass 2 are 3 mm thick and the layers of cured polyester resin 3 are between 1.0 and 0.6 mm thick and preferably 0.8 mm thick.
- 20 The following tests have been carried out on samples manufactured in accordance with the above procedure using 3mm thick sheets of colourless float glass and a 0.8 mm thick layer of cured polyester resin.

Test 1, transmittance of visible and near ultraviolet
radiation

5 The light transmittance characteristics of a sample of
the laminated glazing material was measured in the
visible and ultraviolet regions of the electromagnetic
spectrum between 300 and 700 nm. The results are shown
in Figure 2, where Curve A represents the output from
the tungsten filament lamp, employed as a light source;
10 Curve B represents the amount of light transmitted
through the laminated glazing material, and; Curve C
represents the transmittance characteristics of the
glazing material, adjusted from Curve B to take into
account the output from the lamp (Curve A). It is
15 clear, from Curve C, that the glazing material of the
present invention does not significantly or selectively
attenuate visible light and that it provides an
effective barrier to the passage of ultraviolet light,
between 300 and 380 nm.

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Test 2, transmittance of UV A and UV B

Table 1 shows the UV transmission characteristics of a sample of laminated glazing material prepared according to the invention. The data show transmission values and given wavelengths in the UV A and UV B bands of
5 ultraviolet radiation. It can be clearly seen that the glazing material of the invention provides an effective barrier to the passage of both UV A and UV B.

Table 1

<u>nm</u>	UV AX	<u>nm</u>	TOTAL UV%
=====	=====	=====	=====
317,5	0,00	297,5	0,00
322,5	0,00	302,5	0,00
327,5	0,00	307,5	0,00
332,5	0,00	312,5	0,00
337,5	0,00	317,5	0,00
342,5	0,00	322,5	0,00
347,5	0,00	327,5	0,00
352,5	0,00	332,5	0,00
357,5	0,00	337,5	0,00
362,5	0,00	342,5	0,00
367,5	0,00	347,5	0,00
372,5	0,00	352,5	0,00
377,5	0,35	357,5	0,00
	=====	362,5	0,00
	0,03	367,5	0,00
		372,5	0,00
		377,5	0,35
			=====
			0,03
<u>nm</u>	UV BX		
=====	=====		
297,5	0,00		
302,5	0,00		
307,5	0,00		
312,5	0,00		
	=====		
	0,00		

CLAIMS

1. A glazing material comprising a laminate of a first and second layer of glass, sandwiching a layer of
5 polymeric material, wherein the layer of polymeric material attenuates ultraviolet radiation and the laminate is colourless.
2. A glazing material as claimed in claim 1,
10 wherein the polymeric material absorbs ultraviolet radiation but remains colourless to transmitted light.
3. A glazing material as claimed in claim 1 or claim 2, wherein the laminate filters out at least 90%
15 of the ultraviolet radiation from incident ambient light.
4. A glazing material as claimed in claim 3, wherein the laminate filters out at least 98% of the
20 ultraviolet radiation from incident ambient light.

5. A glazing material as claimed in any of the preceding claims, wherein the layer of polymeric material provides at least 90% of the ultraviolet attenuation of the laminate.

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6. A glazing material as claimed in claim 1, wherein the glass is a colourless float glass.

7. A glazing material as claimed in claim 6, wherein the glass has an iron content of less than 0.03%.

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8. A glazing material as claimed in any of claims 1-7, wherein the layer of polymeric material is between 0.2 and 1.4 mm in thickness.

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9. A glazing material as claimed in any of claims 1-7, wherein the layer of polymeric material is between 0.4 and 1.2 mm in thickness.

10. A glazing material as claimed in any of claims 1-7, wherein the layer of polymeric material is between 0.6 and 1.0 mm in thickness.

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11. A glazing material as claimed in any of claims 1-10, wherein the polymeric material is a cured polyester resin.

5 12. A glazing material as claimed in any of claims 1-11, wherein at least one surface of the laminated glazing material is non-reflective.

10 13. A glazing material as claimed in claim 12, wherein one surface of the glass is coated with a sputtered metal oxide to make it non-reflective.

14. A glazing material as claimed in claim 13, wherein the metal oxide is iron oxide.

15 15. A glazing material as claimed in any of claims 12-14, wherein the residual reflectance of the non-reflective surface is reduced from about 8% to about 1% at 90° to the glass surface.

20 16. A glazing material as claimed in any of claims 12-14, wherein said non-reflective surface has a photopic reflectance of 0.25% or less.

17. A glazing material as claimed in any of claims 1-16, wherein the laminate is also impact resistant.

5 18. A picture frame comprising a glazing material as claimed in any of claims 1-17.

19. A display cabinet for viewing an object contained therein comprising at least one pane of a glazing material as claimed in any of claims 1-17.

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20. Use of a laminating material for providing a colourless laminate which attenuates ultraviolet radiation, wherein the laminating material forms a polymeric layer in the laminate.

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21. Use of a laminating material as claimed in claim 20, wherein the resulting polymeric layer is a cured polyester.

20 22. A glazing material substantially as described in the foregoing example.

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Patents Act 1977
Examiner's report to the Comptroller under
Section 17 (The Search Report)

Application number

GB 9203916.3

Cate

Relevant Technical fields

(i) UK CI (Edition L) B5N

(ii) Int CI (Edition 5) B32B

Search Examiner

R J MIRAMS

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI, CLAIMS

Date of Search

18 MAY 1993

Documents considered relevant following a search in respect of claims

1 TO 22

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2057355 A (ASAHI) Whole document	at least 1 to 5, 8 to 10 and 20
X	GB 1108284 A (GENERAL ELECTRICS) eg page 4 line 60 to page 5 line 1	at least 1 to 5 and 20
X	EP 0396349 A2 (BRIDGESTONE) Whole document	at least 1 to 6,8, 9,20
X	EP 0389208 A1 (NIPPON ZEON) eg page 3 line 56 to page 4 line 1	at least 1,2,8,9, 10,11,17, 20,21
X	EP 0227470 A2 (BRIDGESTONE) eg page 3 lines 18 to 21	at least 1,2,6,11, 20,21

Category	Identity of document and relevant passages	Relevant to claim(s)

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